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TITLE: Method and a circuit arrangement for signal processing in a telecommunication system

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U.S. PATENT DOCUMENTS

PAT-NO	ISSUE-DATE	PATENTEE-NAME	US-CL		
5291474	March 1994	Ikonen et al.	370/30	**N/A**	N/A
5301367	April 1994	**Heinonen**	455/76	N/A	N/A
5390168	February 1995	Vimpari	370/30	**N/A**	N/A
5469115	November 1995	**Peterzell** et al.	330/129	N/A	N/A
5471652	November 1995	Hulkko	455/76	**N/A**	N/A
5519885	May 1996	**Vaisanen**	455/76	N/A	N/A
5572254	November 1996	Kawahara	348/222	**N/A**	N/A
5786782	July 1998	**Ostman** et al.	341/141	N/A	N/A
5790587	August 1998	Smith et al.	375/260	**N/A**	N/A
5878087	March 1999	**Ichihara**	375/316	N/A	N/A

FOREIGN PATENT DOCUMENTS

FOREIGN-PAT-NO	PUBN-DATE	COUNTRY	US-CL
WO 92/2119	November 1996	WO	

ART-UNIT: 274

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ABSTRACT:

The object of the invention is a method and a circuit arrangement for processing a spread spectrum signal and a frequency modulated signal. According to the invention the radio frequency signal is received (1, 2), the received signal is converted into an intermediate frequency signal (3, 4a, 4b), and then an intermediate frequency signal processing (6, 30, 31, 40) is made and the processed intermediate frequency signals are converted (32, 42a, 42b) into baseband signals. The signal derived from the received signal is converted (41) into a digital sampled signal which is processed (32, 42a, 42b, 111, 120, 121) digitally, whereby the either a signal derived from the received spread spectrum signal or a signal derived from the received frequency modulated signal, respectively, is selected (5) as the signal which is converted to the digital sampled signal. According to the invention the same intermediate frequency and baseband components (6, 7, 30, 31, 40, 41) can be used to process both the spread spectrum signal and the frequency modulated signal.

11 Claims, 5 Drawing figures

Exemplary Claim Number: 1

Number of Drawing Sheets: 5

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Brief Summary Text - BSTX (5):

In the spread spectrum receiving branch DSSS the intermediate frequency signal IF is filtered 112 and mixed to the baseband with mixers 114a and 114b. A local oscillator signal LO is supplied to the mixer 114a, and a 90 degrees phase shifted 113 oscillator signal LOb is supplied to the mixer 114b, whereby a baseband signal of the in-phase branch I and a baseband signal of the quadrature branch Q are obtained as mixing results. The baseband signal obtained at the output of the mixer 114a, 114b is filtered 115a, 115b, amplified 116a, 116b and then supplied to an analog-to-digital converter 117a, 117b, which in this example is a 5-bit converter. The digital output signal of the converter 117a, 117b is supplied to the first input of a correlator 118a, 118b. A local spread spectrum generator 119 supplies to the second input of the correlator 118a, 118b a complex **spreading sequence or PN** (Pseudo Noise) sequence, with which the signal supplied to the first input of the correlator is multiplied. The output of the correlator is a digital signal i, q, containing the **despread** signal supplied to the first input.

Detailed Description Text - DETX (6):

The downconversion to the baseband unavoidably will create an interfering spectrum at the frequency2 * IF. Typically this interfering spectrum is attenuated from the resulting baseband signal by digital filtering, which,

however, can be a rather elaborate task, particularly if a high signal-to-interference ratio (SIR) is required of the receiver. In a digital receiver section according to IS-95 the required SIR is of the order of 6 to 10 dB after **despreading** the signal, i.e. the stopband attenuation of the filter has to be higher than 10 dB. According to the inventive solution, such a stopband attenuation is achieved by a simple low-pass filter having a transfer function H(z)=z+1, i.e. the filtering is made by summing two consecutive samples. Since every second sample after downconversion will be zero, the filtering can actually be made simply by doubling the non-zero samples:

Detailed Description Text - DETX (9):
After the downconversion and filtering the signal is **despread** by multiplying the complex signals I, Q by a complex PN sequence, and the resulting signals are then integrated over a predefined number of chips as follows:

Detailed Description Text - DETX (17):
FIG. 3 shows as a simplified block diagram an example of the structure of the conversion block 15, which is required in the receiving branch of a digital system's transmitter/receiver to perform the frequency downconversion, filtering and **despreading** of the signal according to the above formulae (C).

Detailed Description Text - DETX (28):
The second embodiment of the invention presented in FIG. 4 has one drawback in that the **FM-mode receiver** has to be linear. A linear arrangement requires more power than other corresponding arrangements, and a linear receiver must also be equipped with automatic gain control (AGC) in order to provide a sufficient dynamic range (not shown in FIG. 4). The AGC circuits as such are already present for the spread spectrum reception, and they can readily be used also for the **FM receiver,** so that this point will not present any problem in a dual-mode receiver.

Claims Text - CLTX (10):
the sampled intermediate frequency signals are converted into baseband signals, comprising the following steps, namely the spread spectrum signal or the frequency modulated signal is converted into a baseband signal by use of converting means (32, 42a, 42b), the spread spectrum signal is digitally filtered by filtering means (43a, 43b), the spread spectrum of the filtered spread spectrum signal is **despread by use of despreading** means (118a, 118b, 119), the frequency modulated signal is digitally demodulated by use of demodulating means (33), and the sampled signal is filtered by use of filter means (44) in order to separate the speech signal from the intermediate frequency signal.

Claims Text - CLTX (22):
the sampled intermediate frequency signals are converted into baseband signals, comprising the following steps, namely the spread spectrum signal is converted into a baseband signal by use of converting means, the spread spectrum signal is digitally filtered by filtering means, the spread spectrum of the filtered spread spectrum signal is **despread by use of despreading** means, and the sampled signal is filtered by use of filter means in order to separate the speech signal from the intermediate frequency signal.

Claims Text - CLTX (33):

wherein said third conversion means further comprises **despread** means to convert the sampled intermediate frequency spread spectrum signal into a **despread** baseband signal, the **despread** means comprising:

Claims Text - CLTX (53):

despread means to convert the sampled intermediate frequency spread spectrum signal into a **despread** baseband signal, the **despread** means comprising:

Claims Text - CLTX (71):

wherein said third conversion comprises means to digitally filter the spread spectrum signal, means to **despread** the spread spectrum of the filtered spread spectrum signal, means to digitally demodulate the frequency modulated signal, and means to filter the sampled signal in order to separate the speech signal from the intermediate frequency signal.

Claims Text - CLTX (86):

wherein said third conversion means comprises means to digitally filter the spread spectrum signal, means to **despread** the spread spectrum of the filtered spread spectrum signal, and means to filter the sampled signal in order to separate the speech signal from the intermediate frequency signal.